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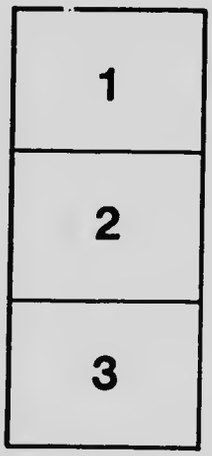

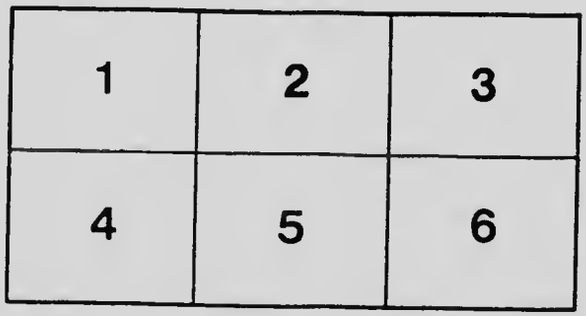

ONTARIO AGRICULTURAL COLLEGE

BULLETIN 122

SPRAY CALENDAR.

DIRECTIONS FOR TREATMENT OF INSECT PESTS AND PLANT DISEASES.

BY

WM. LOCHHEAD, PROFESSOR OF BIOLOGY AND GEOLOGY,

ONTARIO AGRICULTURAL COLLEGE, GUELPH.

1. Thorough, intelligent spraying pays.
2. Spraying is an insurance.
3. Clean up refuse, gather up fallen leaves and fruit in fall, and burn them.
4. Protect birds and beneficial insects.

PUBLISHED BY
THE ONTARIO DEPARTMENT OF AGRICULTURE, TORONTO.
TORONTO, ONT., JUNE, 1902.

Proper method of preparing Bordeaux mixture. The stock solutions are made up and kept in barrels 1 and 2: these are diluted in barrels 3 and 4, and finally mixed in the spray pump, barrel 5.

BULLETIN, 122. **JUNE. 1902.**

Ontario Agricultural College and Experimental Farm.

SPRAY CALENDAR

DIRECTIONS FOR TREATMENT OF INSECT PESTS AND PLANT DISEASES.

By Prof. Wm. Lochhead.

FORMULÆ.

1. Bordeaux Mixture (For Fungous Diseases).

Copper Sulphate (Bluestone)	4 pounds.
Lime (fresh)	"
Water	40 gallons.

In making this mixture, observe the following precautions and directions:

1. *Use nothing but fresh quick-lime.* The lime should be slowly slacked by the gradual addition of water.

For convenience st ck solutions of milk of lime and bluestone should be prepared and kept in different barrels in readiness for spraying operations. In barrel No. 1, 25 pounds of fresh lime are gradually slaked, and barrel made up to 25 gallons of water; in barrel No. 2 25 lbs. of copper sulphate, or bluestone, are dissolved in 25 gallons of water. For rapid dissolving use warm water. These are the stock solutions. Each gallon of milk of lime contains one pound of lime, and each gallon of bluestone solution contains one pound of bluestone When we wish to make up a barrel of Bordeaux mixture, we take out 4 gallons of milk of lime, and 4 gallons of bluestone solution, and either dilute each in separate barrels in 20 gallons of water before mixing in the barrel attached to the spray-pump, or else pour each separately into the barrel in which are already 32 gallons of water. The first method is the preferable one.

2. *Never mix the concentrated stock solutions together.* If the milk of lime and bluestone are mixed in the concentrated form, just as they are taken from the stock solution, a precipitate of a flakey nature will soon settle out, and either fall to the bottom or clog the nozzle.

3. *Test the Bordeaux to find out whether sufficient milk of lime has been added* This is most easily done by means of the ferrocyanide test. A saturated solution of this substance can be purchased at any druggist's for a few cents. In testing, place some of the Bordeaux, which has been thoroughly stirred, into a saucer, and add a few drops of the ferrocyanide. If sufficient lime has been used, no discoloration will appear, but if insufficient, a deep dark brown color will be produced.

4. *Always strain the milk of lime* to prevent gritty particles from clogging the nozzles.

5. *Use a fine nozzle*; do not soak or drench the tree.

6. *The stock solutions will keep*, but the Bordeaux mixture becomes useless after standing for a day or two.

2. The Combination Bordeaux and Paris Green Mixture.

(For Fungous Diseases and Leaf-eating Insects).

This mixture is prepared like the Bordeaux, but 4 ounces of Paris green are added and thoroughly stirred before spraying.

Copper sulphate (Bluestone)	4 lbs.
Quick lime (fresh)	4 lbs.
Paris green	4 oz.
Water (1 barrel)	40 gals.

In small quantities it may be made as follows.

Bluestone	4 level tablespoonfuls.
Quick lime	4 "
Paris green	1 "
Water	1 pail (2 gals)

3. Copper Sulphate (Bluestone or Blue Vitriol).

(For destroying Mustard or Charlock or Herrick in grain fields.)

Copper sulphate	9 pounds.
Water (1 barrel)	45 gallons.

This quantity is sufficient for an acre.

4. Ammoniacal Copper Carbonate Solution.

Copper carbonate	1 ounce.
Strong ammonia sufficient to dissolve the copper carbonate, usually more than	½ pint.
Water	10 gallons.

This solution is not much used, and is recommended only in cases where the fruit is so far advanced that it would be disfigured by using the Bordeaux mixture.

5. Potassium Sulphide (Liver of Sulphur).

(Used to control Gooseberry Mildew.)

Dissolve 4 oz. in 8 gallons of water.

6. Paris Green Mixture. (Liquid.) (For Leaf-eating Insects.)

Paris green	1 pound.
Water	150 gallons.
Lime	2 lb. freshly slacked.

Or,

Paris green	1 teaspoonful (level).
Water	1 pail (2 gallons).
Quick lime	1 teaspoonful (level).

Paris Green Mixture. (Dry.)

Paris green	1 pound.
Flour or dust	100 pounds.

7. Poison Bait. (For Cutworms, Wireworms and Grasshoppers in gardens and cornfields.)

Wheat bran	50 pounds.
Molasses (any kind)	2 quarts.
Paris green (good grade)	1 pound.
Water	(Enough to make a thick mash.)

Handfuls of the bait are scattered about the garden at the base of the plants and among the corn rows in the evening.

8. Hellebore.

White hellebore (fresh)	1 ounce.
Water	2 gallons.

9. Pyrethrum, or Insect Powder.

Pyrethrum powder (fresh)	1 ounce.
Water	3 gallons.

Or,

Pyrethrum Powder	1 ounce.
Flour (cheap)	5 ounces.

Mix thoroughly, allow to stand over night in a closed box, then dust on plants through cheese-cloth.—Recommended for green cabbage worm.

10. Kerosene Emulsion (for Bark-lice and Plant Lice).

Hard soap	½ pound, or soft soap 1 quart.
Boiling water (soft)	1 gallon.
Coal oil	2 gallons.

After dissolving the soap in the water, add the coal oil and stir well for 5 to 10 minutes. When properly mixed, it will adhere to glass without oiliness. A syringe or pump will aid much in this work. In using, dilute with from 9 to 15 parts of water. Kerosene emulsion may be prepared with sour milk (1 gallon) and coal oil (2 gallons), no soap being required. This will not keep long.

11. Tobacco Decoction.

Refuse tobacco	2 pounds.
Water	5 gallons.

Boil the mixture for 30 minutes or more, until a dark brown tea-colored solution is obtained. Keep it covered until cool. It may then be used undiluted for spraying infested plants.

12. Whale Oil Soap.

For Plant Lice. 1 lb. in 7 gallons hot water.

For San José Scale in winter. 2 lbs. in 1 gal. hot water applied as the buds are swelling.

13. Soap Solution.

For Plant Lice on house plants a 5c cake of soap in 4 gals. water.

14. Crude Petroleum. (For San José Scale in early spring.)

A 20 per cent. mechanical emulsion applied by a combination emulsion pump to infested trees just before the buds start. (To be done by an experienced person.)

14 (*a*). Crude Petroleum—Whale Oil Soap Emulsion.

(Recommended for San José Scale, and other hibernating insects.)

Crude petroleum..... .... 2 gallons.
Whale oil soap..... 5 lbs. dissolved in 1½ gallons of boiling water.

Churn thoroughly for 5 minutes or more, and add water to make 10 gallons.

15. Wash for Borers.

First, add soft soap to a saturated solution of washing soda to make a thick paint, then add 1 pint crude carbolic acid, and ½ pound Paris green to 10 gals. of wash.

To be applied to the trunks of apple and maple shade trees in early June.

16. Lime Wash.

(For Oyster-shell Bark Lice, etc.)

Shake 1½ lbs. fresh lime in 1 gallon of water. Strain the wash before spraying. To be applied during winter to trees infested with oyster-shell bark lice.

17. Formalin.

(*a*) *For Potato Scab.* 8 oz or ½ pint in 15 gals. water. Soak seed potatoes in this solution for two hours

(*b*) *For Smut in Oats and Wheat.* 8 oz. or ½ pint in 5 gals. water. Sprinkle thoroughly the seed with this solution.

18. Carbon Bisulphide.

For weevils in peas and grain.

1 lb. or 1 pint for every 100 bushels of grain, or 1,000 cubic feet of space. Liquid placed in shallow dishes on top of grain or peas.

TREATMENT.

APPLE AND PEAR.

A Against Leaf-eating Insects and Fungous Diseases.

Treatment.	When to spray.	Insect pests and diseases controlled.
1. Paris green in water. (Formula B.) (Important.)	Just as leaf-buds are expanding.	Bud-moth, case-bearers.
2. Bordeaux mixture and Paris green. (Formula 2.)	About a week later	Bud-moth, case-bearers, canker-worms, tent caterpillars, scab, leaf-spot and mildew.
3. Bordeaux and Paris green. (Formula 2.) (Important.)	Just before blossoms open.	Canker worms, tent caterpillars, etc. Scab and leaf-spot, etc.
4. Bordeaux and Paris green. (Formula 2.) (Important.)	Just after blossoms fall.	Codling-moth, canker worms, tent caterpillars, pear slug. Scab and leaf-spot.
5. Bordeaux and Paris green. (Formula 2.)	Ten days or two weeks later.	Codling-moth, Palmer worm, apple Bucculatrix. Scab and leaf-spot, etc.

Codling-moths cannot always be controlled by spraying, especially in the south-western section of Ontario, where a second brood appears later in the season.

In addition to spraying, in this district, use bandages around the trees. Make them from four to six inches wide, three or four inches thick, of any kind of cloth. Old bags, sacks, carpets, coarse material of any kind will do. Bands of straw and tow have been used with some success. During the first week in June bind one around each tree three or four feet from the ground; secure it either with cord or small nails; take it off every twelve days, and carefully examine for codling cocoons. These may be readily destroyed by crushing. Replace the bands as before.

Tent-caterpillars are controlled by burning the webs or nests in May; by collecting and destroying the clusters of eggs in fall and winter; by banding the trees; and by spraying the young caterpillars with Paris green.

Canker-worm may be largely controlled by banding the trees in autumn and early spring; and by spraying with Paris green when the worms appear.

B. Against Sucking Insects, such as Plant-lice and Scale Insects, and against Pear Leaf Blister-mites.

Treatment.	When to spray.	Insects controlled.
1. Kerosene emulsion (Formula 10), (1 part in 10 parts water).	Before buds start in spring.	Pear-leaf blister-mite.
2. Kerosene emulsion solution (1 part emulsion to 10 parts water). Or whale-oil soap solution (Formula 12), (1 lb. to 7 gals. water).	As leaves are unfolding.	Pear psylla and aphids.
3. Kerosene emulsion (Formula 10), whale-oil soap as before.	Ten days later	Psylla and aphids.
4. Kerosene emulsion (Formula 10), or whale-oil soap as before.	About end of May or first of June.	Oyster-shell bark-lice.
Or lime wash (No. 16).	During winter.	

C. Treatment for destroying *borers:*

(*a*) Dig out the borers whenever possible.
(*b*) Apply the soap-soda wash (Formula 15) in early June.

Plum and Cherry.

A. Against Curculio, Brown Rot, Shot-hole Fungus, and Leaf-eating Insects.

Treatment.	When to spray.	Insects and diseases controlled.
1. Bordeaux and Paris green. (Formula 2.)	When leaf-buds are opening.	Brown rot, shot-hole fungus.
2. Bordeaux and Paris green. (Formula 2.)	When fruit is formed. .	Curculio, green fruit worms, brown rot, etc.
3. Bordeaux and Paris green. (Formula 2.)	Two weeks later	Brown rot, curculio, etc.
4. Ammonia-copper carbonate solution. (Formula 4.)	When fruit is large. ...	Brown rot, etc.

The *Curculios* are most readily controlled by jarring the trees in early morning, and collecting them on a sheet spread under the tree. The jarring should be begun when the fruit has set, and continued for three weeks. Thrice a week is often enough to jar.

B. Against Plant-lice and Scale Insects.

Treatment.	When to spray.	Insects controlled.
1. Kerosene emulsion (Formula 10), (1 part to 4 parts water.) Or whale-oil soap, (2 lbs. to 1 gal. hot water.) Or petroleum soap emulsion. (Formula 14*a*.)	In winter or early spring.	Plum scale, San José Scale, etc.
2. Kerosene emulsion (Formula 10), (1 part to 10 parts water.) Or whale-oil soap solution. (Formula 12), 1 lb. to 7 gals. water.) Or tobacco solution (Formula 11.)	As soon as lice appear on young leaves.	Plant-lice.

Peach.

A. Against Peach-leaf Curl, Brown Rot, Curculio, Bud-moth.

Treatment.	When to spray.	Insects and diseases controlled.
1. Bordeaux and Paris green. (Formula 2.)	Before flower buds open	Bud-moth and peach leaf curl, brown rot.
2. Bordeaux and Paris green. (Formula 2.)	After blossoms fall	Peach-leaf curl, brown rot, bud-moth and curculio.
3. Bordeaux and Paris green. (Formula 2.)	Two weeks later	Brown rot, etc.
4. Ammonia-coppercarbonate. (Formula 4.)	When fruit is well-formed.	Brown rot, etc.

B. Against Aphis, and Scale Insects.

1. Kerosene emulsion (Formula 10), (1 part in 10 parts) Or whale-oil soap (Formula 12), (1 lb. in 7 gals. water.	Whenever young lice appear.	Aphis.
Whale-oil soap, (2 lbs. in 1 gal. hot water. Or crude petroleum. 25 per cent. mechanical emulsion. (Slightly dangerous.)	In early spring before buds open.	San José scale.

C. Against Peach Tree Borer.

1. Prof. Slingerland recommends *gas tar* as a trunk wash. A trial experiment should be made first on a few trees to find out if it injures the trees, for gas tar varies in composition.
2. Dig out or probe the borers every fall and spring ; and mound up a new base with earth for six inches ; remove and examine in September.
3. Apply Formula in early June.

Grape.

A. Against Black Rot, Mildews and Leaf-eating Insects.

Treatment.	When to spray.	Insects and fungi controlled.
1. Bordeaux and Paris green. (Formula 2.) (Important.)	As buds begin to swell.	Flea-beetle, black rot, mildews.
2. Bordeaux and Paris green. (Formula 2.)	Ten days or two weeks later, before blossoms open.	Black rot, mildews and flea-beetles.
3. Bordeaux and Paris green. (Formula 2.)	Just after blossoming.	Black rot and mildews.
4. Bordeaux and Paris green. (Formula 2.)	Two weeks later.....	Flea beetle and black rot.
5. Ammonia-copper carbonate. (Formula 4.)	When fruit is well formed.	Black rot and mildews.

B. Against Grape Thrip.

1. Kerosene emulsion, 1 part in 9 parts water.	Soon after leaves are formed.	Thrip or leaf-hopper.

Cucumber and Squash.

For the Squash Bug. Kill the early bugs, and the yellowish eggs on the underside of the leaves; kill the bugs every morning which collect under chips and boards placed near the vines.

For the Striped Cucumber-beetle. Keep vines well covered with Bordeaux mixture; cleanliness in garden in fall; protect young vines with muslin, or cheesecloth netting; insect powder and flour as for cabbage worm; tobacco-water and soft soap mixture sprinkled on vines, followed by a dusting of lime.

Asparagus.

For Beetles. Spray plants after cutting season with Paris green; regular cutting of all shoots.

For Rust. Cut and burn all plants in fall.

Cabbage.

For Cabbage Worms and Lice. Pyrethrum applied in solution (1 ounce to 3 gallons of water) or dusted on (1 part pyrethrum to 5 parts flour).

For Cabbage Root-Maggots. No thoroughly reliable remedy is known, but good results have been obtained by using Goff's *Tarred-Paper Cards*. These are pieces of tarred building paper, 3 inches in diameter. In the centre is a hole through which the root of the young cabbage is placed on transplanting. Card lies flat on ground.

Strawberry. The *Rust* or *Leaf-blight.*

Bordeaux mixture, when it can be applied without disfiguring the fruit, will control this disease. Apply at intervals of two or three weeks on new beds after they begin to make runners.

Tomato. *Rot* and *Blight.*

Spray with Bordeaux mixture, as soon as rot or blight appears, three times, if necessary, at intervals of 10 to 15 days.

Potato. *Scab, Blight*, and *Beetles.*

For the Scab: Soak the "seed" potatoes or tubers for two hours in a solution of formalin (8 ozs. in 15 gals. of water)

For Blight and Beetles. First spraying: Paris green as soon as the beetles appear (one pound to 100 gallons of water).

Second spraying: Bordeaux mixture and Paris green when plants are six inches high.

Third and fourth sprayings: Bordeaux mixture at intervals of 10 to 15 days, if necessary.

Spraying with Bordeaux mixture will prevent the blighting of the plants and the rotting of the tubers.

RASPBERRY. *Anthracnose, Leaf-blight* and *Saw-fly Larvæ.*

First: Bordeaux mixture and Paris green just before growth begins.

Second: Bordeaux mixture and Paris green about when first blossoms open.

Third spraying: Bordeaux mixture when the fruit is gathered.

CURRANT AND GOOSEBERRY.

For Worms and Mildew. First spraying: Potassium sulphide or Bordeaux mixture and Paris green before the buds expand.

Second spraying: The same 10 to 15 days later.

For worms alone, hellebore or Paris green will be effective.

For Currant Plant Lice. Spray with kerosene emulsion or whale-oil soap solutions as soon as lice appear; or dust carefully with fine wood ashes.

CELERY. *Leaf-blight.*

First spraying: Bordeaux mixture (Formula 1) while in the seed bed.

Second spraying: Bordeaux mixture a week after transplanting.

PEAS. *Pea-weevil* or *Pea-"bug."*

Fumigate the peas as soon as threshed in tight bins, boxes or oil barrels, by placing carbon bisulphide in shallow pans on top of the peas, and covering the whole tightly for 36 hours. Use 1 lb. for 100 bushels; 1 oz. for 100 lbs. of peas; and a tablespoonful to every cubic foot. The same treatment may be used to kill weevils in grain and in meal. As this gas is explosive great care should be taken not to bring a light near it until it has been ventilated.

MISCELLANEOUS.

COW HORN-FLY. Apply with a brush on the parts most usually attacked a mixture of one quart of seal or fish-oil and one tablespoonful of crude carbolic acid.

MUSTARD. Spray just before the plants come into bloom, on a calm day. Use formula 3, and an ordinary barrel spray pump. A barrel of solution is enough for an acre.

BUFFALO CARPET BEETLE AND BLACK CARPET BEETLE. Take up infested carpets and spray with benzine: fill cracks in floor with putty or plaster paris; lay pieces of red flannel in closets as traps, which should be examined every week.

RED ANTS. Attract to a sponge filled with sugared water, and kill the collected ants by dropping them into boiling water. Repeat.

ROSE SLUGS. Apply hellebore before buds open, and at intervals of a week or ten days.

THRIP, OR LEAF-HOPPER, ON ROSE OR VIRGINIA CREEPER. Use tobacco solution; whale oil soap solution (1 teaspoonful in 2 quarts of water).

RED SPIDER. Syringe or spray with cold water, or tobacco water.